Low sero-prevalence of Contagious Bovine Pleuropneumonia (CBPP) in bulls originated from Borena Pastoral Area of Southern Ethiopia

ARTICLE *in* TROPICAL ANIMAL HEALTH AND PRODUCTION · JANUARY 2014

Impact Factor: 0.82 · DOI: 10.11648/j.avs.20140206.19

3 AUTHORS:

Gezahegn Alemayehu
Samara University
19 PUBLICATIONS **12** CITATIONS
SEE PROFILE

Samson Leta
University of Gondar
18 PUBLICATIONS **41** CITATIONS
SEE PROFILE

Birhanu Hailu
Samara University
16 PUBLICATIONS **5** CITATIONS
SEE PROFILE

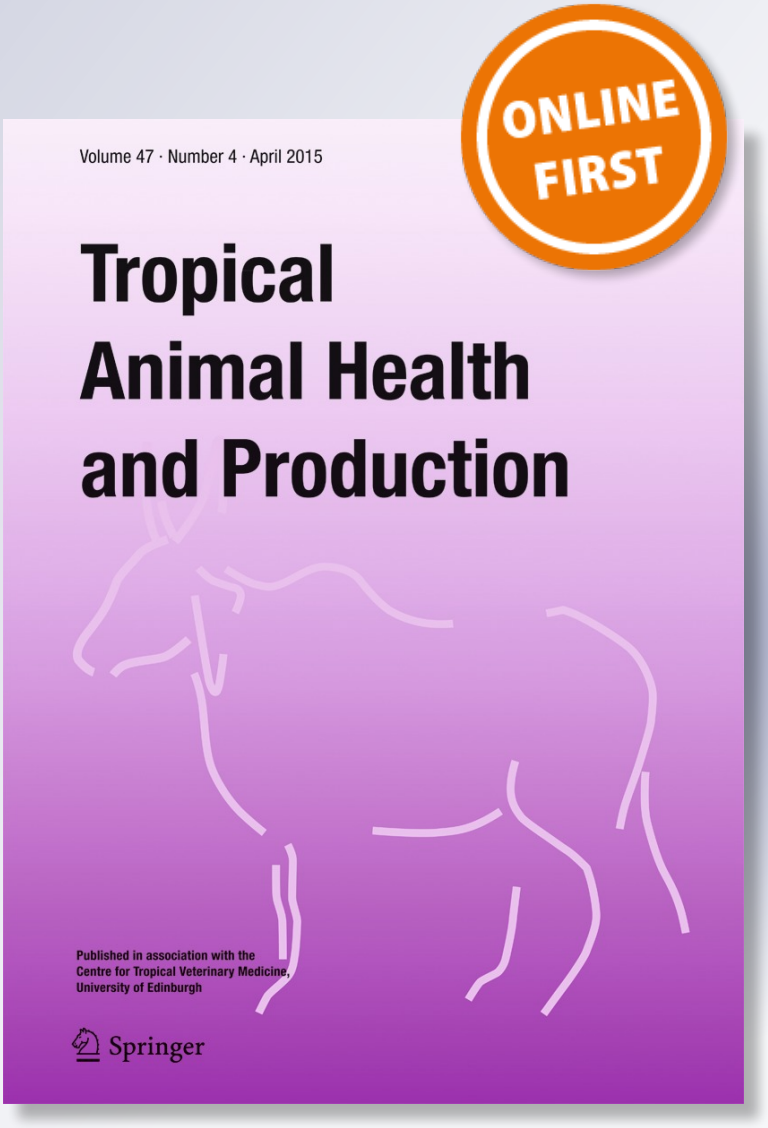
Sero-prevalence of Contagious Bovine Pleuropneumonia (CBPP) in bulls originated from Borena pastoral area of Southern Ethiopia

Gezahegn Alemayehu, Samson Leta & Berhanu Hailu

Tropical Animal Health and Production

ISSN 0049-4747

Trop Anim Health Prod
DOI 10.1007/s11250-015-0820-9



Springer

Trop Anim Health Prod
DOI 10.1007/s11250-015-0820-9

REGULAR ARTICLES

Sero-prevalence of Contagious Bovine Pleuropneumonia (CBPP) in bulls originated from Borena pastoral area of Southern Ethiopia

Gezahegn Alemayehu[1] · **Samson Leta**[2] · **Berhanu Hailu**[1]

Received: 14 November 2014 / Accepted: 31 March 2015

Abstract Contagious Bovine Pleuropneumonia (CBPP) is a highly infectious cattle disease, which is widespread in pastoral areas of Africa, and it imposes a major problem on Ethiopian livestock export market. Cross-sectional study was conducted in 2011 on bulls originated from Borena pastoral area to determine seroprevalence of CBPP. Forty batches of bulls containing 38,187 Borana bulls were tested using c-ELISA. Of the total 40 batches tested for the presence of antibodies, 25 (62.5 %) of them contained at least one seropositive bull. From the total of 38,187 bulls tested, 150 (0.4 %) bulls were positive. The number of seropositive animals increases as the herd size increases ($P<0.05$). Both at herd and individual level, the highest CBPP prevalence was recorded in herd size >1000, and the difference was found statistically significant ($P<0.05$). There was statistically significant ($\chi^2=23.73$, df=9, $P=0.005$) difference of CBPP prevalence between months of the year. The present low prevalence of CBPP in the cattle feedlots indicates that the disease is decreasing progressively in Borena pastoral area, this might be associated with the ongoing mass vaccination campaign against economically important livestock diseases in pastoral areas. The decrease in the prevalence of CBPP offered a great opportunity to livestock producers and live animal and meat exporters by improving the demand of Ethiopian livestock on international market. Regular reintroduction of infected cattle from neighboring countries or herds where the disease remains endemic may change the disease dynamics again. Therefore, mass blanket vaccinations coupled with prompt diagnosis, isolation and stamping out of the outbreaks, intensive surveillance, followed by strict cattle movement control should be implemented by concerned parties.

Keywords Borena · Bull · CBPP · Ethiopia · Pastoral area

✉ Gezahegn Alemayehu
gezahegnayalew@yahoo.com

[1] College of Veterinary Medicine, Samara University, P.O.Box 132, Samara, Ethiopia

[2] College of Veterinary Medicine, University of Gondar, Gondar, Ethiopia

Introduction

Contagious Bovine Pleuropneumonia (CBPP) is a highly infectious cattle disease, which is caused by *Mycoplasma mycoides* subsp. *mycoides* SC (small colony, bovine biotype). It is widespread in pastoral areas of Africa, and it is a major problem for Ethiopian livestock development (Masiga et al. 1996). Although CBPP was once found worldwide, it was eradicated from most continents, by the mid-twentieth century. Its incidence also began to decline in Africa by the 1970s. However, because of the economic and financial difficulties that affected the ability of governments to adequately fund Veterinary Services, the disease came back in the late 1980s and early 1990s (Tambi et al. 2006; Rovid 2008). Major CBPP epidemics have been experienced in Eastern, Southern, and West Africa over the last few years. Currently, it affects 27 countries in Africa with an estimated annual cost of US$2 billion (Otte et al. 2004). A total of 2719 outbreaks were reported in Africa between 1995 and 2002. Countries in East Africa reported 66 % of the total outbreaks (58 % in Ethiopia and Tanzania and 8 % in other countries in the region) (Tambi et al. 2006).

The livestock subsector has an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopians, and still promising to rally round the economic development of the country (Metaferia et al. 2011; Behnke

Published online: 12 April 2015

2010). However, transboundary animal diseases (TADs) such as CBPP constrain the livestock sector of the country and affect livelihoods via their impact on animal health, animal food production, availability, and quality.

Pastoral areas output underpins almost all of Ethiopia's live animal and meat exports. A large percentage of the cattle and beef meat exported from Ethiopia originates from Borena pastoral area (Farmer 2010). However, this area as a whole was infected since long time (Afework 2000). CBPP is number one important disease in Borena area (Rufael et al. 2008). Prevalence rates ranging between 9.4 and 74 % were recorded in Borena cattle (Issa 2004; Roger and Yigezu 1995). Even though rinderpest eradication has been achieved in Ethiopia, the persistence of CBPP effectively limits trade opportunities. A constraint to this potential for market access is the ability of the country to meet ever-increasing requirements for food safety and sanitary and phytosanitary standards (SPS) requirement of World Trade Organization (WTO). It follows that attempts to improve international market access for livestock producers in the developing world must include improving the capacity of these countries to operate within the SPS Agreement and the OIE's Terrestrial Animal Health Code, while ensuring that the requirements are equitable, justifiable, and effective.

Increased international trade in livestock and livestock products is also an argument for more support for the veterinary services in the control of CBPP. Despite widespread recognition of the prime importance of livestock for pastoral societies, TADs such as CBPP continue to be an effective brake on marketing opportunities for these often poor communities. The occurrence of such diseases impacts both poor and richer livestock producers by marginalizing them from higher price livestock markets and restricting their capacity for value-added trade (FAO 2002). Movement restrictions and local quarantines mean the closure of livestock markets and reduced or no opportunities for sale of live animals and possibly meat and other products. In addition to the measurable economic impact on a national economy, the inability to sell their animal can bring severe hardship to a pastoral family with no other income of sources of support (Steffen et al. 1998; Holleman 2002).

In order to secure international market, Ethiopian government needs to meet WTO requirement by demonstrating their responses towards CBPP control. The challenge of CBPP control in endemic settings will require active partnerships to overcome the limitations of insufficient epidemiological information from the country on the basis of which to develop targeted measures, and limited capacity and national resources to apply control measures based on mass vaccination or effective movement control. The admission of large numbers of bulls into feedlots facilities for a period of time ranging from 3 to 4 months offered an excellent opportunity to study CBPP prevalence in the Borena pastoral area of Southern Ethiopia where the bulls were originated. Therefore, the objective of this study was to determine the seroprevalence of CBPP in bulls originated from Borena pastoral area of Southern Ethiopia.

Materials and methods

Study areas

The study was conducted on bulls at finishing phase for export in East Shewa zone brought from Borena pastoral area. Borana pastoral area of Southern Ethiopia, located between 03° 37′ 23.8″ to 05° 02′ 52.4″ North and 37° 56′ 49.4″ to 39° 01′ 1°1″East, in Oromia Regional States (Fig. 1). The altitude ranges from 970 masl in the south bordering Kenya to 1693 m above sea level in the Northeast. The Borana pastoral area represents a vast lowland area, covering about 95,000 km^2 (Coppock 1994). Livestock is an integral part of the Borana people that serve several purposes: as source of food, income generation, and social prestige (Desta 1999). East Shewa zone is located in the central parts of Ethiopia. Absolute location of the zone extends from 7° 33′ 50″ N to 9° 08′ 56″ N and 38° 24′ 10″ E to 40° 05′ 34″ E (Fig. 1) which indicate that this zone is located in tropical climatic zone though the climate is influenced by altitudinal variation. The total area of East Shewa zone is approximately 9633.52 km^2. The altitude ranges from 500 to 4307 m above mean sea level. The zone can be categorized under rift valley of Ethiopia since about 93 % of the total area of the zone is completely located in rift valley. East Shewa zone is the predominant zone with regard to the number and size feedlot operators.

Study design and subject

Cross-sectional study was conducted for 1 year period from January 2011 to December 2011 to determine seroprevalence of CBPP on 40 batches of bulls admitted in 20 different feedlots facilities. A total of 38,187 apparently health bulls intended for export were included in the study. The bulls were originated from Borena pastoral area, and they are on finishing stage for export in East Shewa zone. The animals were not subjected to veterinarian inspection and selection during purchase in the markets, and they were not tested for any diseases before they were moved into feedlots. Bulls were transported by truck from their production area (Borena pastoral area) to feedlots in East Showa zone. All animals used for study were male with 3–5 years age category and vaccinated for CBPP.

Serum samples collection and processing

As part of SPS requirements and rules and regulations of animal quarantine, it is a requirement that all animals being

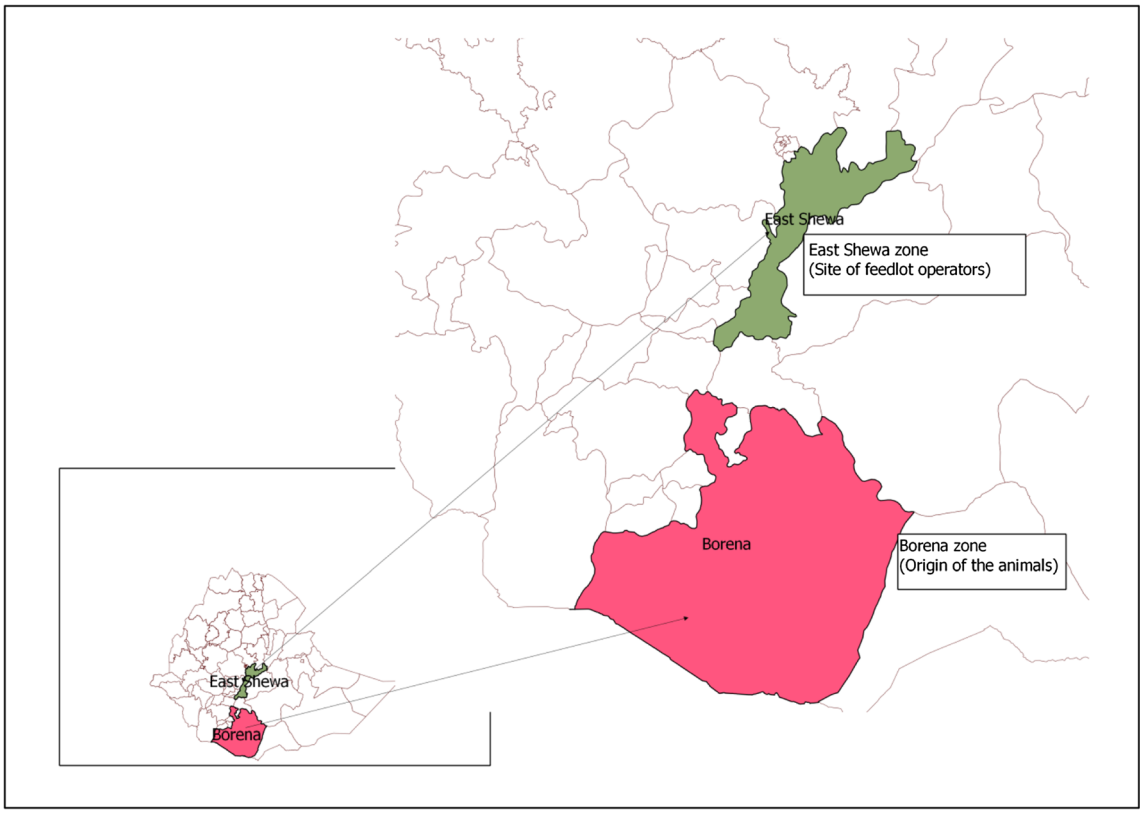


Fig. 1 Study area

exported to Arabian countries are tested for CBPP; therefore, all bulls being exported were subjected to blood sample collection. Serum samples (n=38,187) collected for 1 year (2011) period for certifications purposes from bulls were used for seropositivity determination. Blood samples were aseptically collected using 10 ml plain vacutainer tubes from apparently healthy bulls through jugular venipuncture. The tubes were then labeled with tag number of animals and kept protected from direct sun light in slant position until the blood clotted and sera were separated. The clotted blood or separated sera were transported to National veterinary institute (NVI) laboratory and National Animal Health Diagnostic and Investigation Centre (NAHDIC) for investigation. Serum samples were examined for antibodies using a Competitive Enzyme Linked Immuno-Sorbent Assay (c-ELISA) to identify CBPP seropositive and negative animals following the manufacturer's instructions. A commercially available test kit (Pourquier Institute, France) was used. For economic reasons, the tests were interpreted as negative for results below 45 % and positive above 45 %.

Data analysis

Data were classified, filtered, coded using MS Excel, and was transferred to Statistical Package for Social Sciences Software version 20. Descriptive statistics was performed to summarize seroprevalence of CBPP at batch and individual level. The association between the number of CBPP positive animals in a given feedlot and the number of animals in a feedlot was assessed using negative binomial regression. In all analysis, confidence level was held at 95 % and $P \leq 0.05$ was set for significance.

Results

Of the total 40 batches tested for the presence of antibodies using c-ELISA, 25 (62.5 %) of them contained at least one

Table 1 Prevalence of CBPP in different feedlot sites

Sites of feedlots	Number of bulls tested	Prevalence
Dera	2090	14(0.7)
Modjo	484	0(0.0)
Adama	12,180	38(0.3)
Wanji	2136	4(0.2)
Koshe	6399	19(0.3)
Mekie	3544	40(1.1)
Awash Melkasa	2417	6(0.2)
Awash 7 killo	4338	15(0.3)
Nahmaled	3469	10(0.3)
Adami Tulu	1130	4(0.4)

Table 2 Batches seroprevalence of CBPP in different herd sizes

Variables	Number of tested batches	Number of positive (%)	95 % CI	X^2	*P* value
Herd size					
<500	13	4(30.8)	9.1–61.4	12.548	0.002
500–100	11	6(54.5)	23.4–83.3		
>1000	16	15(93.8)	69.8–99.8		

seropositive bull. From the total of 38,187 bulls tested, 150 (0.4 %) bulls were found positive. At batches level, highest prevalence was recorded in feedlots found Dera, Mekie, Awash 7 killo, Nahmaled, and Adami Tulu sites(100 %), although it is vaccinated animals and lowest was recorded in feedlots found Modjo and Awash Melkasa sites. At individual animal level, the highest seropositivity was recorded in Mekie (1.1 %), and the lowest was recorded in Modjo site (0.0 %) Table 1.

Among the three herd size categories, both at herd and individual level, the highest CBPP prevalence was recorded in herd size >1000, and the difference was found statistically significant ($P<0.05$) (Tables 2 and 3). The number of seropositive animals increases as the herd size increases ($P<0.05$)

At individual animal level, highest prevalence was recorded in July month (0.7) and lowest was recorded in June (0.1 %) (Fig. 2). There was statistically significant ($\chi^2=23.73$, df=9, $P=0.005$) difference of CBPP prevalence between months of the year.

Discussion

Low seroprevalence of CBPP (0.4 %) was obtained in this study. Previous study conducted by Kassaye and Molla (Kassaye and Molla 2012) during a period of 2010–2011 reported a 4 % seroprevalence of CBPP at export quarantine centers in and around Adama, Ethiopia. A relatively higher seroprevalence was reported by Kassaye and Molla (2012); however, the bulls used for the study has no history of vaccination against CBPP. Higher seroprevalences were also recorded in the previous studies conducted in Borena zone, 5.1 % prevalence by Issa (2004) and 74 % prevalence by Roger and Yigezu (1995). The lower seroprevalence in this study might be due to the ongoing annual mass vaccination program at pastoral production level. The Ethiopian government and other non-governmental organizations have been conducting annual mass vaccinations campaign against economically most important TADs. This fact is supported by Masiga and Domenech (1995) in which annual mass vaccination has been used with good results in East Africa and much of West Africa.

The increase of CBPP prevalence as herd size increase seen in this study may be due to the fact that risk of an individual animal introduced infection into negative herd may increase with herd size, and lateral spread of infection within the herd may be favored. There was statistically significant ($P=0.005$) difference between month of the year with highest seropositivity on July (0.7 %) and lowest on June (0.1 %). The test for CBPP was conducted after 3 months of bulls purchased from Borena pastoral area. The higher prevalence of the disease in month of July might be the reflection of rainy month of May at Borena pastoral area. Since the disease has higher prevalence in humid climate than dry climates due to the fact that infected droplets can be inactivated by ultraviolet light (Provost et al. 1987).

The present low prevalence CBPP in the cattle feedlots indicates that the disease is decreasing progressively in Borena pastoral area. Government strategy in animal health service provision through mass vaccination of CBPP and antibiotic treatment plays a great role for the reduction of disease in Borena pastoral area. However, regular reintroduction of cattle from neighboring countries or herds where the disease remains endemic will maintain the infection and clinical disease will develop again as soon as the vaccination campaigns cease (Masiga et al. 1996). Therefore, mass blanket vaccinations coupled with prompt diagnosis, isolation and stamping out of the outbreaks, intensive surveillance, followed by strict cattle movement control should be implemented by Ethiopian Veterinary Services to eradicate the disease. As Borena pastoral area is the main source of live cattle and meat export. Eradication of CBPP from Borena pastoral areas is therefore increases the participation of the country in the lucrative markets for livestock and livestock products.

Table 3 Seroprevalence of CBPP in Borena bulls in relation to herd sizes

Variables	Number of tested bulls	Number of positive (%)	95% CI	X^2	*P* value
Herd size					
<500	3663	10(0.3)	0.1–0.5	14.40	0.001
500–1000	8954	18(0.2)	0.1–0.3		
>1000	25,570	122(0.5)	0.4–0.6		

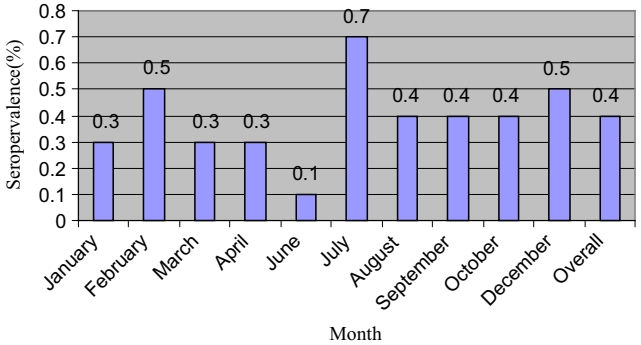


Fig. 2 Monthly seroprevalence of CBPP in bull originated from Borena pastoral area in 2011

It should be noted that the values presented in this study are obtained from serum sample collected from bulls which were selected based on good body condition. Bulls intended for finishing were purchased based on their good body condition and health, the probability of purchasing chronically ill or recovered animals with poor body condition is therefore very low. This might also account for lower prevalence of diseases in the feedlots. In Ethiopia, antibiotic is also used for the treatment of the disease for long time. This may also be the reason for low seroprevalence of the disease by reducing a detectable serological response (OIE 2009).

This study presents important piece information with regard to the disease status in pastoral Borena area. However, due to the above mentioned study limitation of the study, the figures presented here might not demonstrate the true prevalence of CBPP in Borena pastoral production area. Therefore, clinical diagnosis, serological surveillance, and post-mortem examination of lesions at abattoir are essential at primary production level to know the true prevalence of CBPP.

Acknowledgments We would like to express our gratitude to all feedlots owners found in East Shewa zone for their all-round cooperation during survey. We are also very grateful to Dr. Kimiya Mohamed and Dr. Tegist Bantirugu Adama plant and animals quarantine service center senior inspectors.

Conflict of interest The authors have not declared any conflict of interest

References

Afework, Y., 2000. Analysis of CBPP situation in Ethiopia, Past and Present. Ministry of Agriculture, Addis Ababa, Ethiopia.

Behnke, R., 2010. The Contribution of Livestock to the Economies of IGAD Member States: Study Findings, Application of the Methodology in Ethiopia and Recommendations for Further Work. IGAD LPI Working Paper 02-10. Great Wolford, UK: Odessa Centre, IGAD Livestock Policy Initiative. In.

Coppock, D. L., 1994. The Borana Plateau of Southern Ethiopia: Synthesis of Pastoral Research Development and Change, 1980-91. (International Livestock Centre for Africa, Addis Ababa)

Desta, S., 1999. Diversification of Livestock assets for risk management in the Borana pastoral Area of Southern Ethiopia, PhD thesis, Utah State University, Logan, Utah. pp: 10-31

FAO, 2002. Improved animal health for poverty reduction and sustainable livelihoods. FAO Animal Production and Health Paper 153. Rome.

Farmer, E., 2010. End Market Analysis of Ethiopian Livestock and Meat. A Desk Study Micro report 164.

Holleman, C.F., 2002. The socio-economic implications of the livestock ban in Somalia. Famine Early Warning Area Network: Nairobi, Kenya.

Issa, A., 2004. Epidemiological study of contagious bovine pleuropneumonia in Borena pastoral area using Complement fixation test and Competitive enzyme-linked immunosorbent assay (ELISA). (MSC thesis). Addis Ababa University, Faculty of Veterinary Medicine, Debre zeit, Ethiopia.

Kassaye ,D. and W. Molla, 2012. Seroprevalence of contagious bovine pleuropneumonia at export quarantine centers in and around Adama, Ethiopia. *Trop. Anim. Health. Prod*. 45(1):275-9

Masiga, W.N. and J. Domenech, 1995. Overview and epidemiology of contagious bovine pleuropneumonia in Africa. Revue Scientifique et Technique del Office International des Epizooties., 1 4 (3), 611-620.

Masiga, W.N., J. Domenech & R.S. Windsor, 1996. Manifestation and epidemiology of contagious bovine pleuropneumonia in Africa. *In* Animal mycoplasmoses and control Revue Scientifique et Technique del Office International des Epizooties, 15 (4), 1283-1308.

Metaferia, F., T. Cherenet, A. Gelan, F. Abnet, A. Tesfay, J.A. Ali and W. Gulilat, 2011. A Review to Improve Estimation of Livestock Contribution to the National GDP. Ministry of Finance and Economic Development and Ministry of Agriculture, Addia Ababa, Ethiopia.

OIE, 2009. Contagious Bovine Pleuropneumonia. Paris. Scientific.Dept@Oie.Int. Accessed April 2011.

Otte, M.J., R.Nugent and A.Mcleod, 2004. Transboundary animal diseases: socio-economic impacts and institutional response. FAO Livestock policy discussion paper 9.

Provost, A., P. Perreau, A.B..réard, C. L E Goff, J.L. Martel & G.S. Cottew, 1987. Contagious bovine pleuropneumonia. *In* Mycoplasmoses of ruminants. Revue Scientifique et Technique del Office International des Epizooties, 6 (3), 625-679.

Roger, F and L. Yigezu, 1995. The Situation of CBPP in Ethiopia. CIRAD-EMVT and National Veterinary Institute, Ethiopia.

Rovid, S.A., 2008. Contagious bovine pleuropneumonia. The center for food security and public health, Iowa State University. College of Veterinary Medicine. http://www.cfsph.iastate.edu. Accessed April 2012.

Rufael, T., A. Catley, A. Bogale, M.Sahle and Y. Shiferaw., 2008. Foot and Mouth Disease in Borana Pastoral Area, Southern Ethiopia. Tropical Animal Health and Production, 40, 29–38. Doi:10.1007/s11250-007-9049-6.

Steffen, P., A.H. Shirwa and S.I. Addou, 1998. The livestock embargo by Saudi Arabia: a report on the economic, financial, and social impact on Somaliland and Somalia. FEWS NET.

Tambi., N.E., W.O. Maina and C.Ndi, 2006. An estimation of the economic impact of contagious bovine pleuropneumonia in Africa. Revue Scientifique et Technique del Office International des Epizooties, 25 (3), 999-012.